

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
 US Department of Commerce
 United States Patent and Trademark
 Office, PCT
 2011 South Clark Place Room
 CP2/5C24
 Arlington, VA 22202
 ETATS-UNIS D'AMERIQUE
 in its capacity as elected Office

Date of mailing (day/month/year)
 26 June 2001 (26.06.01)

International application No.
 PCT/FI00/00860

Applicant's or agent's file reference
 BP100394

International filing date (day/month/year)
 05 October 2000 (05.10.00)

Priority date (day/month/year)
 05 October 1999 (05.10.99)

Applicant

PIHLAJA, Juha

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
 02 May 2001 (02.05.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
 34, chemin des Colombettes
 1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Odile ALIU

Telephone No.: (41-22) 338.83.38

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(Copy for the Elected Office (EO/US))

PATENT COOPERATION TREATY

PCT/FI00/00860

PCT

**NOTIFICATION OF THE RECORDING
OF A CHANGE**

(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

BERGGREN OY AB
P.O. Box 16
FIN-00101 Helsinki
FINLANDE

Date of mailing (day/month/year) 17 December 2001 (17.12.01)	
Applicant's or agent's file reference BP100394	IMPORTANT NOTIFICATION
International application No. PCT/FI00/00860	International filing date (day/month/year) 05 October 2000 (05.10.00)

1. The following indications appeared on record concerning:

☒ the applicant ☐ the inventor ☐ the agent ☐ the common representative

Name and Address

NOKIA OYJ
Nokia-talo
Keilalahdentie 4
FIN-02150 Espoo
Finland

State of Nationality

FI

State of Residence

FI

Telephone No.

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person ☒ the name ☒ the address ☐ the nationality ☐ the residence

Name and Address

NOKIA CORPORATION
Keilalahdentie 4
FIN-02150 Espoo
Finland

State of Nationality

FI

State of Residence

FI

Telephone No.

Facsimile No.

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer François BAECHLER
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference BP100394	<div style="display: flex; justify-content: space-between;"> <div>FOR FURTHER ACTION</div> <div>see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.</div> </div>	
International application No. PCT/FI 00/00860	International filing date (<i>day/month/year</i>) 5 October 2000	(Earliest) Priority Date (<i>day/month/year</i>) 5 October 1999
Applicant Nokia Oyj et al		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
- b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:
- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (See Box II).

4. With regard to the title,

- ☒ the text is approved as submitted by the applicant.
- ☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

- ☒ the text is approved as submitted by the applicant.
- ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No. 2

- ☒ as suggested by the applicant.
- ☐ because the applicant failed to suggest a figure.
- ☐ because this figure better characterizes the invention.
- ☐ None of the figures.

1
INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00860

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04B 7/26, H03M 13/05

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04B, H04Q, H04L, H03M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4555774 A (LAWRENCE BERNSTEIN), 26 November 1985 (26.11.85), column 2, line 3 - line 17 --	1-15
A	US 5323395 A (MICHAEL HENRION), 21 June 1994 (21.06.94), claim 1, abstract --	1-15
A	EP 0557130 A2 (MITSUBUSHI DENKI KABUSHIKI KAISHA), 25 August 1993 (25.08.93), abstract --	1-15
A	EP 0844566 A1 (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.), 27 May 1998 (27.05.98), column 8, line 33 - column 9, line 11 --	1-15

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

22 January 2001

Date of mailing of the international search report

29-01-2001

Name and mailing address of the ISA

Swedish Patent Office

Box 5055, S-102 42 STOCKHOLM

Facsimile No. +46 8 666 02 86

Authorized officer

Peder Gjervaldsaeter/mj

Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00860

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Patent Abstracts of Japan, abstract of JP 61-174845 A (MITSUBISHI ELECTRIC CORP), 6 August 1986 (06.08.86) --	1-15
P,A	GB 2338382 A (NEC CORPORATION), 15 December 1999 (15.12.99), abstract -- -----	1-15

INTERNATIONAL SEARCH REPORT
Information on patent family members

27/12/00

International application No.

PCT/FI 00/00860

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4555774 A	26/11/85	CA 1193745 A DE 3367984 D EP 0116554 A,B SE 0116554 T3 JP 3017264 B JP 59501607 T WO 8400838 A	17/09/85 00/00/00 29/08/84 07/03/91 06/09/84 01/03/84
US 5323395 A	21/06/94	AT 167972 T AU 659254 B AU 2999792 A CA 2085664 A DE 69226070 D,T EP 0547958 A,B SE 0547958 T3 ES 2120437 T FR 2685592 A,B JP 2648546 B JP 5260120 A NO 305460 B NO 924735 D	15/07/98 11/05/95 24/06/93 19/06/93 12/11/98 23/06/93 01/11/98 25/06/93 03/09/97 08/10/93 31/05/99 00/00/00
EP 0557130 A2	25/08/93	DE 69328642 D JP 5235776 A US 5627694 A US 5633632 A JP 2962027 B JP 5244014 A	00/00/00 10/09/93 06/05/97 27/05/97 12/10/99 21/09/93
EP 0844566 A1	27/05/98	JP 10149618 A US 6047340 A	02/06/98 04/04/00
GB 2338382 A	15/12/99	GB 9820107 D CN 1176548 A GB 2315964 A,B GB 9716206 D JP 10051509 A KR 224048 B	00/00/00 18/03/98 11/02/98 00/00/00 20/02/98 15/10/99

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ SE

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA		Date of receipt of DEMAND	
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference BP100394/SKU/PKK	
International application No. PCT/FI00/00860	International filing date (day/month/year) 5 October 2000 (05.10.00)	(Earliest) Priority date (day/month/year) 5 October 1999 (05.10.99)	
Title of invention A DATA TRANSMISSION METHOD			
Box No. II APPLICANT(S)			
Name and address: (Family name followed by given name; for a legal entity, full official designation) The address must include postal code and name of country. NOKIA OYJ Nokia-talo, Keilalahdentie 4, FIN-02150 ESPOO, Finland		Telephone No.	
		Facsimile No.	
		Teleprinter No.	
State (that is, country) of nationality: Finland		State (that is, country) of residence: Finland	
Name and address: (Family name followed by given name; for a legal entity, full official designation) The address must include postal code and name of country. PIHLAJA, Juha Latvatie 11 H, FIN-02150 ESPOO, Finland			
State (that is, country) of nationality: Finland		State (that is, country) of residence: Finland	
Name and address: (Family name followed by given name; for a legal entity, full official designation) The address must include postal code and name of country.			
State (that is, country) of nationality:		State (that is, country) of residence:	
<input type="checkbox"/> Further applicants are indicated on a continuation sheet			

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Box No III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination ☐☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked ☐☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier ☐Name and address: *(Family name followed by given name; for a legal entity, full official designation)*
*The address must include postal code and name of country*BERGGREN OY AB
P.O. Box 16, FIN-00101 HELSINKI, Finland

Telephone No

+358 9 693 701

Facsimile No

+358 9 693 3944

Teleprinter No

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent ☐**Box No IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***1 ☐ The applicant wishes the international preliminary examination to start on the basis of:☒ the international application as originally filedthe description ☒ as originally filed☐ as amended under Article 34the claims ☒ as originally filed☐ as amended under Article 19 (together with any accompanying statement)☐ as amended under Article 34the drawings ☒ as originally filed☐ as amended under Article 342 ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed ☐3 ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69(d)) ☐ (This check-box may be marked only where the time limit under Article 19 has not yet expired)* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended ☐Language for the purposes of international preliminary examination: English☒ which is the language in which the international application was filed ☐☒ which is the language of a translation furnished for the purposes of international search ☐☒ which is the language of publication of the international application ☐☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination ☐**Box No V ELECTION OF STATES**

The applicant hereby elects all eligible States (that is, all States which have been designated and which are bound by Chapter II of the PCT)

excluding the following States which the applicant wishes not to elect:

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Box No VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1 <input type="checkbox"/> translation of international application | : | sheets |
| 2 <input type="checkbox"/> amendments under Article 34 | : | sheets |
| 3 <input type="checkbox"/> copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4 <input type="checkbox"/> copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5 <input type="checkbox"/> letter | : | sheets |
| 6 <input type="checkbox"/> other (specify) | : | sheets |

For International Preliminary Examining Authority use only

received not received

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- | | |
|---|--|
| 1 <input checked="" type="checkbox"/> fee calculation sheet | 4 <input type="checkbox"/> statement explaining lack of signature |
| 2 <input type="checkbox"/> separate signed power of attorney | 5 <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3 <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6 <input type="checkbox"/> other (specify): |

Box No VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand)

BERGGREN OY AB



Sirpa Kuisma
Patent Attorney

HELSINKI, Finland, 2 May 2001

For International Preliminary Examining Authority use only

1 ☐ Date of actual receipt of DEMAND:

2 ☐ Adjusted date of receipt of demand due to CORRECTIONS under Rule 60 I(b):

3 ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply

☐ The applicant has been informed accordingly

4 ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80 I

5 ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82

For International Bureau use only

Demand received from IPEA on:

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PCT

FEE CALCULATION SHEET

Annex to the Demand for international preliminary examination

International application No PCT/FI00/00860	For International Preliminary Examining Authority use only	
Applicant's or agent's file reference BP100394/SKU/PKK	Date stamp of the IPEA	
Applicant <div style="text-align: center; font-weight: bold;">NOKIA OYJ</div>		
Calculation of prescribed fees <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 45%;"> <p>1 <input type="checkbox"/> Preliminary examination fee </p> <p>2 <input type="checkbox"/> Handling fee <i>(Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.)</i> </p> <p>3 <input type="checkbox"/> Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box </p> </div> <div style="width: 45%; text-align: right;"> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">SEK 5000</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">SEK 1270</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">SEK 6270</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">TOTAL</div> </div> </div>		
Mode of Payment <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><input type="checkbox"/> authorization to charge deposit account with the IPEA (see below)</p> <p><input type="checkbox"/> cheque</p> <p><input type="checkbox"/> postal money order</p> <p><input checked="" type="checkbox"/> bank draft via SWIFT through account 5439-10-013-49</p> </div> <div style="width: 45%;"> <p><input type="checkbox"/> cash</p> <p><input type="checkbox"/> revenue stamps</p> <p><input type="checkbox"/> coupons</p> <p><input type="checkbox"/> other (specify):</p> </div> </div>		
Deposit Account Authorization <i>(this mode of payment may not be available at all IPEAs)</i> The IPEA/ <u>SE</u> <input type="checkbox"/> is hereby authorized to charge the total fees indicated above to my deposit account <input type="checkbox"/> <input type="checkbox"/> <i>(this check-box may be marked only if the conditions for deposit accounts of the IPEA so permit)</i> is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account <input type="checkbox"/>		
Deposit Account Number	Date (day/month/year)	Signature

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PCT REQUEST

1/4

BP100394

Original (for SUBMISSION) - printed on 05.10.2000 02:29:26 PM

0	For receiving Office use only	
0-1	International Application No.	
0-2	International Filing Date	
0-3	Name of receiving Office and "PCT International Application"	
0-4	Form - PCT/RO/101 PCT Request	
0-4-1	Prepared using	PCT-EASY Version 2.91 (updated 01.07.2000)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	National Board of Patents and Registration (Finland) (RO/FI)
0-7	Applicant's or agent's file reference	BP100394
I	Title of invention	A DATA TRANSMISSION METHOD
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	NOKIA OYJ
II-5	Address:	Nokia-talo Keilalahdentie 4 FIN-02150 Espoo Finland
II-6	State of nationality	FI
II-7	State of residence	FI
III-1	Applicant and/or inventor	
III-1-1	This person is:	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	PIHLAJA, Juha
III-1-5	Address:	Latvatie 11 H FIN-02150 Espoo Finland
III-1-6	State of nationality	FI
III-1-7	State of residence	FI

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PCT REQUEST

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BP100394

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IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	BERGGREN OY AB
IV-1-2	Address:	P.O. Box 16 FIN-00101 Helsinki Finland
IV-1-3	Telephone No.	+358-9-693701
IV-1-4	Facsimile No.	+358-9-6933944
IV-1-5	e-mail	email.box@berggren.fi
V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<p>AP: GH GM KE LS MW MZ SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT</p> <p>EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT</p> <p>EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT</p> <p>OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT</p>
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<p>AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH&LI CN CR CU CZ DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW</p>

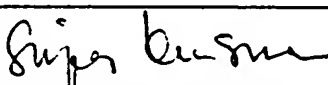
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PCT REQUEST

3/4

BP100394

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V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	Exclusion(s) from precautionary designations	NONE
VI-1	Priority claim of earlier national application	
VI-1-1	Filing date	05 October 1999 (05.10.1999)
VI-1-2	Number	19992148
VI-1-3	Country	FI
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1
VII-1	International Searching Authority Chosen	Swedish Patent Office (ISA/SE)
VIII	Check list	number of sheets electronic file(s) attached
VIII-1	Request	4 -
VIII-2	Description	12 -
VIII-3	Claims	3 -
VIII-4	Abstract	1 bp100394.txt
VIII-5	Drawings	4 -
VIII-7	TOTAL	24
VIII-8	Accompanying items	paper document(s) attached electronic file(s) attached
VIII-8	Fee calculation sheet	✓ -
VIII-9	Separate signed power of attorney	✓ -
VIII-16	PCT-EASY diskette	- diskette
VIII-18	Figure of the drawings which should accompany the abstract	2
VIII-19	Language of filing of the international application	English
IX-1	Signature of applicant or agent	
IX-1-1	Name	BERGGREN OY AB
IX-1-2	Name of signatory	Sirpa Kuisma
IX-1-3	Capacity	Patent Agent

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Original (for SUBMISSION) - printed on 05.10.2000 02:29:26 PM

FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	

FOR INTERNATIONAL BUREAU USE ONLY

11-1	Date of receipt of the record copy by the International Bureau	
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PCT (ANNEX - FEE CALCULATION SHEET)

BP100394

Original (for SUBMISSION) - printed on 05.10.2000 02:29:26 PM

(This sheet is not part of and does not count as a sheet of the international application)

0	For receiving Office use only		
0-1	International Application No.		
0-2	Date stamp of the receiving Office		
0-4	Form - PCT/RO/101 (Annex)		
0-4-1	PCT Fee Calculation Sheet Prepared using	PCT-EASY Version 2.91 (updated 01.07.2000)	
0-9	Applicant's or agent's file reference	BP100394	
2	Applicant	NOKIA OYJ, et al.	
12	Calculation of prescribed fees	fee amount/multiplier	total amounts (FIM)
12-1	Transmittal fee T	⇒	800
12-2	Search fee S	⇒	5 618,71
12-3	International fee		
	Basic fee (first 30 sheets) b1	2 431,8	
12-4	Remaining sheets	0	
12-5	Additional amount (X)	53,51	
12-6	Total additional amount b2	0	
12-7	b1 + b2 = B	2 431,8	
12-8	Designation fees		
	Number of designations contained in international application	87	
12-9	Number of designation fees payable (maximum 8)	8	
12-10	Amount of designation fee (X)	523,22	
12-11	Total designation fees D	4 185,76	
12-12	PCT-EASY fee reduction R	-749,16	
12-13	Total International fee (B+D-R) I	⇒	5 868,4
12-14	Fee for priority document		
	Number of priority documents requested	1	
12-15	Fee per document (X)	0	
12-16	Total priority document fee P	⇒	0
12-17	TOTAL FEES PAYABLE (T+S+I+P)	⇒	12 287,11
12-19	Mode of payment	cheque	

VALIDATION LOG AND REMARKS

13-2-3	Validation messages Names	Green? Applicant 1.:Telephone No. missing
		Green? Applicant 1.:Facsimile No. missing

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 23 JAN 2002

WIPO

PCT

Applicant's or agent's file reference BP100394/SKU/PPK	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/FI00/00860	International filing date (day/month/year) 05.10.2000	Priority date (day/month/year) 05.10.1999
International Patent Classification (IPC) or national classification and IPC ₇ H 04 B 7/26, H 03 M 13/05		
Applicant Nokia Corporation et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 02.05.2001	Date of completion of this report 09.01.2002
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Peder Gjervaldsaeter/AE Telephone No. 08-782 25 00

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I. Basis of the report**1. With regard to the elements of the international application:***

- ☒ the international application as originally filed
- ☐ the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description. pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings. sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are unannexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00860

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-15</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-15</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-15</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The documents cited in the International Search Report represent the prior art. The claimed invention stated in claims 1-15 is not considered to be anticipated by these documents. None of the documents or any relevant combination of them reveal transmission of a data sequence as described by these claims.

According to the arguments stated above, the invention claimed in claims 1-15 is novel, considered to involve an inventive step and have industrial applicability.

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PATENTTI- JA REKISTERIHALLITUS

Patentti- ja innovaatiolain Patents and Innovations

Search Report
TUTKIMUSRAPORTTI

PATENTTIHAKEMUS NRO Appln. no. 19992148	LUOKITUS classification H04L29/02
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TUTKITTU AINEISTO Searched material
Patenttijulkaisukokoelma (FI, SE, NO, DK, DE, CH, EP, WO, GB, US), tutkitut luokat Published patent specific. Searched classes H04L1, H04L12, H04L29, H04J3, H03M7, H03M13, H04Q11
Tiedonhaut ja muu aineisto Data search and other material EPODOC, WPI, PAJ

VIITEJULKAISUT		
Kategoria*) Category	Julkaisun tunnistetiedot Identific. data	Koskee vaatimuksia Relevant to claims
A	EP0866589, H04L29/02, NTT MOBILE COMMUNICATIONS NETWORK INC., palsta 1 rivi 10 - palsta 18 rivi 57	1, 7, 11
A	EP0935363, H04L1/00, KABUSHIKI KAISHA TOSHIBA, sivu 3 rivit 12 - 45, sivu 5 rivi 51 - sivu 6 rivi 44, sivu 21 rivi 48 - sivu 24 rivi 27, sivu 31 rivi 10 - sivu 33 rivi 10	1, 7, 11 1, 7, 11
A	EP0786919, H04Q11/04, International Business Machines Corporation, palsta 4 rivit 20 - 33	1, 7, 11
A	EP1022927, H04Q11/04, FUJITSU LIMITED, [0022 - 0027], [0030 - 0037]	1, 7, 11
X	US5333135, H04J3/26, North American Philips Corporation, palsta 4 rivi 19 - palsta 5 rivi 5.	1
*) X Patentoitavuuden kannalta merkittävä julkaisu yksinään tarkasteltuna Y Patentoitavuuden kannalta merkittävä julkaisu, kun otetaan huomioon tämä ja yksi tai useampi samaan kategoriaan kuuluva julkaisu A Yleistä tekniikan tasoa edustava julkaisu, ei kuitenkaan patentoitavuuden este		
Päiväys 14.11.2000	Tutkija Alpo Tuomi	

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(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
12 April 2001 (12.04.2001)

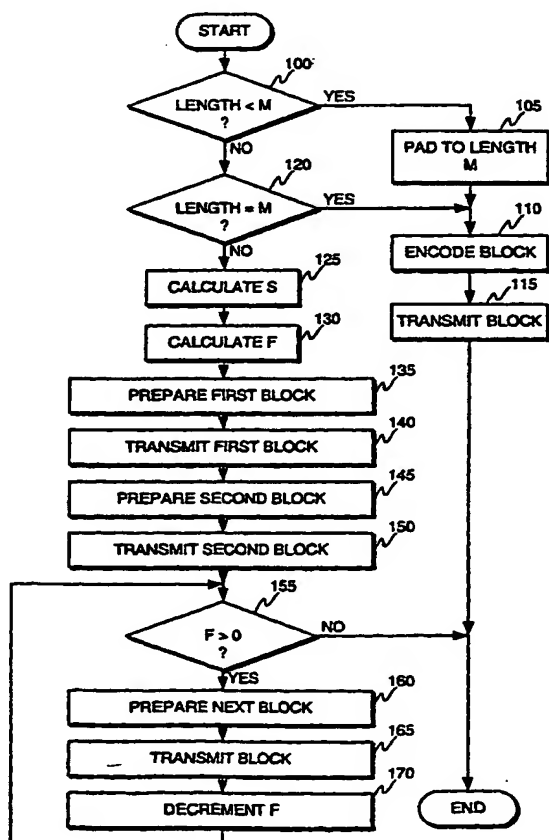
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(10) International Publication Number
WO 01/26254 A1

- (51) International Patent Classification⁷: H04B 7/26, H03M 13/05 (74) Agent: BERGGREN OY AB; P.O. Box 16, FIN-00101 Helsinki (FI).
- (21) International Application Number: PCT/FI00/00860 (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (22) International Filing Date: 5 October 2000 (05.10.2000)
- (25) Filing Language: English
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- (71) Applicant (*for all designated States except US*): NOKIA OYJ [FI/FI]; Nokia-talo, Keilalahdentie 4, FIN-02150 Espoo (FI).
- (72) Inventor; and
- (75) Inventor/Applicant (*for US only*): PIHLAJA, Juha [FI/FI]; Latvatie 11 H, FIN-02150 Espoo (FI).
- Published:
— With international search report.

[Continued on next page]

(54) Title: A DATA TRANSMISSION METHOD



(57) Abstract: The invention is related to coding and decoding data, more particularly in microwave radio link systems. According to the invention, the sequence of data to be encoded at a transmitting end is split into at least two blocks, if the sequence is longer than a first predetermined length M. The splitting is performed so that the length first block is equal to the first predetermined length M. If the remaining sequence is shorter than a second predetermined length N, the second block comprises all of the remaining sequence. If the remaining sequence is longer than the second predetermined length N, the length of the second block is found by subtracting from the length of the remaining sequence the highest integer multiple of the second predetermined length, and the rest of the sequence is split into blocks of length N. If the sequence is shorter than the first predetermined length M, only one block is produced, and the sequence is padded with dummy values to form a sequence of length M. If the sequence is exactly M units long, the first and in that case the only block comprises the whole sequence. The blocks are then separately encoded with the desired coding function.

WO 01/26254 A1

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— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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INTERNATIONAL SEARCH REPORT

1

International application No.

PCT/FI 00/00860

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04B 7/26, H03M 13/05

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04B, H04Q, H04L, H03M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4555774 A (LAWRENCE BERNSTEIN), 26 November 1985 (26.11.85), column 2, line 3 - line 17 --	1-15
A	US 5323395 A (MICHAEL HENRION), 21 June 1994 (21.06.94), claim 1, abstract --	1-15
A	EP 0557130 A2 (MITSUBUSHI DENKI KABUSHIKI KAISHA), 25 August 1993 (25.08.93), abstract --	1-15
A	EP 0844566 A1 (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.), 27 May 1998 (27.05.98), column 8, line 33 - column 9, line 11 --	1-15

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

22 January 2001

29-01-2001

Name and mailing address of the ISA/
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00860

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Patent Abstracts of Japan, abstract of JP 61-174845 A (MITSUBISHI ELECTRIC CORP), 6 August 1986 (06.08.86) --	1-15
P,A	GB 2338382 A (NEC CORPORATION), 15 December 1999 (15.12.99), abstract -- -----	1-15

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INTERNATIONAL SEARCH REPORT

Information on patent family members

27/12/00

International application No.

PCT/FI 00/00860

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
US	4555774	A	26/11/85	CA	1193745 A	17/09/85
				DE	3367984 D	00/00/00
				EP	0116554 A,B	29/08/84
				SE	0116554 T3	
				JP	3017264 B	07/03/91
				JP	59501607 T	06/09/84
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US	5323395	A	21/06/94	AT	167972 T	15/07/98
				AU	659254 B	11/05/95
				AU	2999792 A	24/06/93
				CA	2085664 A	19/06/93
				DE	69226070 D,T	12/11/98
				EP	0547958 A,B	23/06/93
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GB	2338382	A	15/12/99	GB	9820107 D	00/00/00
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				KR	224048 B	15/10/99

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A data transmission method

BACKGROUND OF THE INVENTION

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1. Field of the Invention

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The invention is related to coding and decoding data, more particularly in microwave radio link systems. Especially, the invention is related to such a method as described in the preamble of claim 1.

2. Description of Related Art

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The problems of prior art can be illustrated with reference to point-to-multipoint (PMP) radio systems, in which the access points (AP) operate in full-duplex mode and terminals (Access Terminal, AT) operate in half-duplex mode. Figure 1 illustrates the structure of such a system. Figure 1 shows terminals 10, an access point 20, and a telecommunications network 30. Typically such systems are used to provide fixed wireless connections between a central station i.e. an access point 20 (AP) and several fixed substations i.e. access terminals 10 (AT). Such systems are very advantageous in environments, where provision of fixed lines would cause prohibitive costs, such as in cities. Typically such systems are used to link base stations of a cellular telecommunications network to a central station 20, which is connected to rest of the telecommunications network 30. Such systems are also often used for providing wireless local area networks (WLAN). Such systems are also often used to provide connections between public networks and private business and residential customers.

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In many cases such systems use time division to separate signals of the terminals from each other, i.e. they are arranged to transmit at different times. For simplicity and reasons of cost, terminals typically operate in half-duplex mode, i.e. the terminals cannot transmit and receive at the same time. The access points are typically capable of full-duplex operation. The number of access points in a network is considerably lower than the number of terminals, whereby the requirements for low cost are not as stringent as in the case of terminals and the structure of access points can be more complicated.

One example of such a system is the HIPERACCESS and HIPERLAN systems specified by the European Telecommunications Standards Institute. The HIPERACCESS system is described in detail in the ETSI specification DTR/BRAN-010001 "Broadband Radio Access Networks (BRAN): Requirements
5 and architectures for HIPERACCESS fixed networks".

Such systems need error correction mechanisms in order to ensure that the transmitted data is correct. One typically used error correction method is Reed-Solomon coding, which is especially well suitable for correcting error bursts, i.e.
10 errors in which a number of consecutive bits are in error. In the Reed-Solomon method, a certain number of parity symbols are calculated from the data to be transmitted and appended to the data. The data and the appended parity symbols are transmitted to a receiver, which can detect and correct errors on the basis of the information in parity symbols. However, the Reed-Solomon method has the
15 drawback, that the receiver needs to know the number of symbols in a transmission block, i.e. the number of payload data and the number of parity symbols calculated from the payload data. This is problematic in cases, when the length of transmitted messages vary. One straightforward solution is to use a constant transmission block size which is specified to be large enough, that any possible transmitted message
20 will fit in the block. If the message to be transmitted does not fill the whole block, the rest of the block is padded with dummy values for transmission, which dummy values are removed by the receiver from the received data. This solution has the drawback, that it creates an excessive overhead for the transmission of short messages.

25 These problems are typically found in transmission of broadcast messages in PMP radio link systems, in which messages the access point sends announcements and control information to the terminals. Better solutions are clearly needed.

30 SUMMARY OF THE INVENTION

An object of the invention is to realize a transmission method, which requires only very little overhead. A further object of the invention is to realize a transmission method, which allows the transmission of variable length messages without
35 excessive overhead.

The objects are reached by transmitting a message in pieces whose lengths are determined using a previously agreed set of rules, encoding the first piece in a

previously agreed way, and indicating the total length of the message in the first piece. The receiver can then receive and decode the first piece, and from the information contained in the first piece, the receiver can determine the lengths and coding methods of the other pieces.

5

The method according to the invention is characterized by that, which is specified in the characterizing part of the independent method claim. The transmitter according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a transmitter. The receiver according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a receiver. The access point of a microwave radio link system according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to an access point of a microwave radio link system. The terminal of a microwave radio link system according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a terminal of a microwave radio link system. The dependent claims describe further advantageous embodiments of the invention.

20 According to the invention, the sequence of data to be encoded at a transmitting end is split into at least two blocks, if the sequence is longer than a first predetermined length M. The splitting is performed so that the length first block is equal to the first predetermined length M. If the remaining sequence is shorter than a second predetermined length N, the second block comprises all of the remaining sequence.

25 If the remaining sequence is longer than the second predetermined length N, the length S of the second block is found by subtracting from the length of the remaining sequence the highest integer multiple of the second predetermined length, and the rest of the sequence is split into blocks of length N. If the sequence is shorter than the first predetermined length M, only one block is produced, and the

30 sequence is padded with dummy values to form a sequence of length M. If the sequence is exactly M units long, the first and in that case the only block comprises the whole sequence. The blocks are then separately encoded with the desired coding function.

35 In this description, the indication of the length of the data sequence to be coded is assumed to be present in the beginning of the sequence, for example as a predetermined number of bytes indicating the total length of the sequence including the length indication. Such a sequence can naturally be produced from any data

sequence to be transmitted by calculating the length of the sequence, adding to the length the length of the length indication, and prepending the result to the sequence. The indication of the total length is comprised in the first block, which allows the decoding of the coded blocks by the receiver. Since the first block is of a predetermined size, it can be decoded directly. The total length of the data sequence is observed from the contents of the first block, and by reversing the calculation used to determine the amount and lengths of the rest of the blocks in the transmitting end, the receiver can determine the lengths of the following blocks, and therefore is able to correctly receive and decode them.

The unit of length i.e. the size of a data symbol may be different in different embodiments of the invention. Advantageously, the data symbol comprises 8 bits i.e. one byte, and the length of the data sequence is counted in bytes. For most practical purposes at least for PMP microwave radio link use, the sequence length indication can be realized using two bytes, which allows a sequence to be 65535 bytes long. However, the invention is not limited to the length being specified by exactly two bytes, since the length of the indication is merely a result of practical considerations pertinent to the particular application of the invention.

In one advantageous embodiment, the coding method used is Reed-Solomon coding, which is quite widely used in telecommunications. However, the invention is not limited only to Reed-Solomon coding, since other coding methods can be used as well in various embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in more detail in the following with reference to the accompanying drawings, of which

Figure 1 illustrates a PMP system according to prior art,

Figure 2 illustrates a method according to an advantageous embodiment of the invention,

Figure 3 illustrates a transmitter according to an advantageous embodiment of the invention,

Figure 4 illustrates a receiver according to an advantageous embodiment of the invention, and

Figure 5 illustrates an access point and a terminal of a microwave radio link system according to an advantageous embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A. A FIRST GROUP OF ADVANTAGEOUS EMBODIMENTS OF THE INVENTION

In the following, a method according to an advantageous embodiment is described with reference to figure 2. The figure illustrates processing of data at the transmitting end.

In the beginning, it is checked 100 if the length of the data sequence to be transmitted is smaller than the predefined limit M. If it is, padding symbols are added 105 to the sequence to make the length to be exactly M, whereafter the resulting data block is encoded 110 and transmitted 115. If the length of the data sequence is not smaller than M, it is checked 120 if the length equals M. If it does, the sequence is encoded 110 and transmitted 115.

The predefined limit M may advantageously be for example 8, which allows the transmission of very short messages in one transmission block without significant overhead. Naturally, other values may be used for M, which for optimal use of radio resources should advantageously be not much larger than the length of some frequently repeating short messages in order to avoid overhead.

If the length of the data sequence was not found to be equal to M in step 120, the sequence is longer than M, wherefore more than one transmission block will be needed. For this end, the length S of the second block is calculated in step 125 and the number F of further blocks is calculated in step 130.

The number F of further blocks is simply the integer part of the result of division of the remaining length of the data sequence after subtraction of M by the predetermined length N of the further blocks, i.e.

$$F = \text{INT}((\text{LENGTH} - M) / N) \quad (1)$$

where LENGTH is the length of the data sequence to be transmitted, and INT is a function returning the integer part of its argument. The length S can be calculated simply by

$$S = (\text{LENGTH} - M) \text{ MOD } N \quad (2)$$

where $a \text{ MOD } b$ is the modulo function returning the remainder of an integer division of a/b .

Next, the first transmission block is prepared by picking from the original data sequence the first M symbols and encoding them, after which the encoded block is transmitted. After this, the second transmission block is prepared by picking from the original data sequence the following S symbols and encoding them, after which the encoded block is transmitted.

In the next step, it is checked if the value of F is greater than zero. If it is not, no more blocks need to be sent and the method is ended. If the value is greater than zero, the next transmission block is prepared by picking from the original data sequence the following N symbols and encoding them, after which the encoded block is transmitted. The value of F is decremented by one, after which the method is continued again from step 155.

Figure 2 is only an example of an advantageous embodiment of the invention, and the invention is not limited to only the method shown in figure 2. For example, the steps of transmitting blocks 115, 140, 150, 165 can as well be performed after all other steps, if the encoded blocks are temporarily stored in a memory unit for the duration of the preparation of other transmission blocks.

The value of N can advantageously be for example 128, which is suitable for Reed-Solomon coding of symbols comprising 8 bits.

The receiver needs to know the values M and N, and the coding method used in order to decode the received transmission blocks. From the knowledge of M and the coding method, the receiver knows how many symbols belong to the first transmission block, and is therefore able to receive and decode the first transmission block. The receiver can then read the length indication, and determine if a second

transmission block will be received and its length, as well as the number of any possible further transmission blocks.

B. A SECOND GROUP OF ADVANTAGEOUS EMBODIMENTS OF THE INVENTION

In an advantageous embodiment of the invention, Reed-Solomon coding is used for coding of the blocks for transmission. In one advantageous embodiment the first block is encoded using 4 parity symbols, whereby the first transmission block comprises 12 symbols in total, i.e. 8 data symbols and 4 parity symbols, which allows the correction of 2 erroneously received symbols. In a further advantageous embodiment of the invention, the second block is encoded for transmission using 6 parity symbols, if the block is shorter than 32 symbols, and using 8 parity symbols, if the block is equal to or longer than 32 symbols. In a still further advantageous embodiment of the invention, the further blocks are encoded using 8 parity symbols. The number of parity symbols used in the Reed-Solomon coding may be different in different embodiments of the invention. It is only necessary that both the transmitter and the receiver know the number of parity symbols used to allow correct reception of a transmission block and error detection and correction according to the Reed-Solomon method.

C. A THIRD GROUP OF ADVANTAGEOUS EMBODIMENTS OF THE INVENTION

In a further advantageous embodiment of the invention, information indicating a coding method or a parameter of a coding method for decoding of subsequent transmission blocks is transmitted in the first transmission blocks. For example, in the case of Reed-Solomon coding, the number of parity symbols used in decoding of subsequent blocks can be transmitted. As another example, an identifier of a set of rules for determining the number of parity symbols can be transmitted in the first block.

In an advantageous embodiment of the invention, one bit of the length indication symbols is used for identifying the amount of parity symbols used in Reed-Solomon decoding of subsequent blocks. In this exemplary embodiment, the symbols have eight bits, and the length is indicated using a length indication field of two symbols of whose bits one is used for the identification of the amount of parity symbols, which leaves 15 bits for the length indication itself. In this exemplary embodiment,

if the identification bit is '0', all blocks are encoded using 4 parity symbols. If the identification bit is '1', the subsequent blocks are encoded using 8 parity symbols. Said identification bit can be for example the first bit of the first symbol of the length indication field. In such an embodiment, the transmitter can select between
5 two coding grades, i.e. a weaker coding having less overhead and a stronger coding having more overhead, according to current radio interface conditions.

In a further advantageous embodiment of the invention, the coding method indication comprises more bits than one bit, for example one symbol. In such an
10 embodiment, there can be more than one coding grade options allowing the transmitter finer control over the transmission process.

D. A FOURTH GROUP OF ADVANTAGEOUS EMBODIMENTS OF THE INVENTION

15 The invention can be applied especially well in point to multipoint (PMP) microwave radio link systems. In the following, one such an embodiment is described to illustrate one possible use of the invention.

20 In the PMP system, multiple terminals communicate with an access point. In this embodiment, the inventive method is used for transmission of broadcast messages from the access point to the terminals. According to the embodiment, the terminals are grouped into two groups. A first group of the two groups is arranged to listen during a first half of a time period and a second group of the two groups is arranged
25 to listen during the second half of the time period. The broadcast messages are sent twice i.e. once during said first half of the time period and once during said second half of the time period, whereby all terminals are able to receive the broadcast messages, and half of the terminals are able to transmit at the time when the other half is receiving a broadcast message.

30 The broadcast messages transmitted by the access point comprise various control information, such as for example the identifier of the access point, identifier of the network operator, and identifier of the transmission sector. The broadcast messages may also comprise other types of information such as information about an access
35 time slot, during which new terminals may initiate communication with the access point. The broadcast messages also indicate the reception periods of individual terminals. Consequently, the two broadcast messages have some parts in common,

while terminal-specific parts are naturally different in the two broadcast messages of a frame. Also, the broadcast messages may vary in length from frame to frame.

Typically, the access point specifies the transmission periods allocated for a terminal in an individual transmission to the terminal, along with other terminal specific control information and possibly payload data. A terminal does not need to receive during other times as the broadcast message times and reception times indicated by the AP. During the other times, a terminal may transmit if transmission is allowed by the AP, or the terminal may be in idle mode in order to save power.

Since the length broadcast messages vary, the inventive transmission method is used for transmission of the broadcast messages from the access point to the terminal. In addition to allowing the variable length of the message, the inventive method allows the message to have an arbitrary length without lengthening of the time required for decoding of the received message, since the decoding is performed in pieces. The whole message is ready and error corrected quickly after reception of the last transmission block, i.e. after the time required to decode and correct the last transmission block. In the case of a long message, the time is much shorter than in the case, that the long message would have been sent in one block.

E. A FIFTH GROUP OF ADVANTAGEOUS EMBODIMENTS OF THE INVENTION

According to an advantageous embodiment of the invention a method for transmission of a sequence of data is provided. In the method,

- the sequence of data is transmitted in more than one block,
- the first transmitted block has a predetermined length, and
- the first transmitted block comprises information indicating the length of the sequence of data.

According to a further advantageous embodiment of the invention, the length S of the part of the sequence of data encoded in the second transmission block is

$$S = (\text{LENGTH} - M) \text{ MOD } N$$

where M is the length of the part of the sequence of data transmitted in the first block, N is a predetermined integer constant, LENGTH is the length of the sequence of data, and MOD is the modulo function.

According to a further advantageous embodiment of the invention, the method further comprises a step, in which at least one transmission block of a third type is transmitted.

- 5 According to a further advantageous embodiment of the invention, the number F of said transmission blocks of said third type is calculated by

$$F = \text{INT}((\text{LENGTH} - M) / N)$$

where LENGTH is the length of the sequence of data to be transmitted, M is the length of the part of the sequence of data transmitted in the first block, N is a
10 predetermined integer constant specifying the length of a part of the sequence of data transmitted in a transmission block of said third type, and INT is a function returning the integer part of its argument.

According to a further advantageous embodiment of the invention, the first
15 transmitted block further comprises information about a parameter of encoding of the subsequent blocks.

According to a further advantageous embodiment of the invention, the method is
20 used in a microwave radio link system.

F. A SIXTH GROUP OF ADVANTAGEOUS EMBODIMENTS OF THE INVENTION

According to a further advantageous embodiment of the invention, a transmitter 300
25 of a microwave radio link system is provided. Figure 3 illustrates said transmitter 300. According to the embodiment, the transmitter 300 comprises at least

- means 301 for splitting a sequence of data to be transmitted into at least two blocks, a first block of said at least two blocks having a predetermined size,
- means 302 for specifying the length of said sequence in said first block,
- 30 - means 303 for encoding said blocks for transmission, and
- means 304 for transmitting said blocks, said first block first.

According to a further advantageous embodiment of the invention, the transmitter 300 further comprises means 305 for calculating the length S of the part of the
35 sequence of data encoded in the second transmission block as

$$S = (\text{LENGTH} - M) \text{ MOD } N$$

where M is the predetermined length of the part of the sequence of data transmitted in the first block, N is a predetermined integer constant, LENGTH is the length of the sequence of data, and MOD is the modulo function.

- 5 According to a further advantageous embodiment of the invention, said means for splitting is arranged to split said sequence of data into a first block, a second block and at least one third block if said sequence of data is longer than the sum of two predetermined lengths, the two predetermined lengths being the length of the part of the sequence of data transmitted in the first block and the length of a part of the
10 sequence of data transmitted in a third block.

According to a further advantageous embodiment of the invention, the transmitter 300 further comprises means 306 for calculating the number F of said third transmission blocks as

15
$$F = \text{INT}((\text{LENGTH} - M) / N)$$

- where LENGTH is the length of the sequence of data to be transmitted, M is the length of the part of the sequence of data transmitted in the first block, N is a predetermined integer constant specifying the length of the part of the sequence of data transmitted in a transmission block of said third type, and INT is a function
20 returning the integer part of its argument.

According to a still further advantageous embodiment of the invention, a receiver 400 of a microwave radio link system is provided. Figure 4 illustrates the receiver 400. According to the embodiment, the receiver 400 comprises

- 25 - means 401 for receiving and decoding a first transmission block comprising a part of a data sequence to be received,
- means 402 for determining the length of said data sequence on the basis of information in said first transmission block, and
- means 403 for determining the length of a second transmission block to be
30 received at least partly on the basis of said length of said data sequence, and
- means 404 for determining the number of at least third transmission blocks to be received, if any.

- According to a further advantageous embodiment of the invention, an access point
35 21 of a microwave radio link system is provided. According to the embodiment, the access point comprises a transmitter 300 according to any of the previous paragraphs describing a transmitter. According to a still further advantageous

embodiment of the invention, the access point further comprises a receiver 400 according to any of the previous paragraphs describing a receiver.

According to a still further advantageous embodiment of the invention, a terminal 11 of a microwave radio link system is provided. According to the embodiment, the terminal comprises a receiver 400 according to any of the previous paragraphs describing a receiver. According to an even further advantageous embodiment of the invention, the terminal further comprises a transmitter 300 according to any of the previous paragraphs describing a transmitter.

Figure 5 illustrates an access point 21 and a terminal 11 of a microwave radio link system according to an advantageous embodiment of the invention.

G. FURTHER CONSIDERATIONS

The invention has several advantages. For example, the invention allows the coding and decoding of variable length sequences of data with decoding methods, which require the knowledge of the length of the coded sequence in order to decode it. Further, padding is not needed which saves the precious capacity of the air interface, except in those cases when the data sequence to be transmitted is extremely short. The invention also allows decoding of parts of a long sequence being received, since the decoding is performed in pieces which are separately encoded. The invention is also able to reduce time between the reception of the last symbols of a data sequence and obtaining the whole decoded sequence, since the decoding is performed in pieces, and most of the sequence is already decoded when the last symbols are received and the decoding of the last piece commences. Further, the decoding unit does not need to be capable of decoding a long message, which simplifies the circuit structure of the unit.

In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention. While a preferred embodiment of the invention has been described in detail, it should be apparent that many modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention.

Claims

1. Method for transmission of a sequence of data,
characterized in that

- 5 - the sequence of data is transmitted in more than one block,
 - the first transmitted block has a predetermined length, and
 - the first transmitted block comprises information indicating the length of the
 sequence of data.

- 10 2. A method according to claim 1, characterized in that
 the length S of the part of the sequence of data encoded in the second transmission
 block is

$$S = (\text{LENGTH} - M) \text{ MOD } N$$

- 15 where M is the length of the part of the sequence of data transmitted in the first
 block, N is a predetermined integer constant, LENGTH is the length of the sequence
 of data, and MOD is the modulo function.

- 20 3. A method according to claim 1, characterized in that
 it further comprises a step, in which at least one transmission block of a third type is
 transmitted.

4. A method according to claim 3, characterized in that
the number F of said transmission blocks of said third type is calculated by

$$F = \text{INT}((\text{LENGTH} - M) / N)$$

- 25 where LENGTH is the length of the sequence of data to be transmitted, M is the
 length of the part of the sequence of data transmitted in the first block, N is a
 predetermined integer constant specifying the length of a part of the sequence of
 data transmitted in a transmission block of said third type, and INT is a function
 returning the integer part of its argument.

30

5. A method according to claim 1, characterized in that
the first transmitted block further comprises information about a parameter of
encoding of the subsequent blocks.

- 35 6. A method according to claim 1, characterized in that
 the method is used in a microwave radio link system.

7. A transmitter of a microwave radio link system, characterized in that the transmitter comprises at least

- means for splitting a sequence of data to be transmitted into at least two blocks, a first block of said at least two blocks having a predetermined size,
- 5 - means for specifying the length of said sequence in said first block,
- means for encoding said blocks for transmission, and
- means for transmitting said blocks, said first block first.

8. A transmitter according to claim 7, characterized in that

10 it further comprises means for calculating the length S of the part of the sequence of data encoded in the second transmission block as

$$S = (\text{LENGTH} - M) \text{ MOD } N$$

where M is the predetermined length of the part of the sequence of data transmitted in the first block, N is a predetermined integer constant, LENGTH is the length of
15 the sequence of data, and MOD is the modulo function.

9. A transmitter according to claim 7, characterized in that

said means for splitting is arranged to split said sequence of data into a first block, a second block and at least one third block if said sequence of data is longer than the
20 sum of two predetermined lengths, the two predetermined lengths being the length of the part of the sequence of data transmitted in the first block and the length of a part of the sequence of data transmitted in a third block.

10. A transmitter according to claim 9, characterized in that

25 it further comprises means for calculating the number F of said third transmission blocks as

$$F = \text{INT}((\text{LENGTH} - M) / N)$$

where LENGTH is the length of the sequence of data to be transmitted, M is the length of the part of the sequence of data transmitted in the first block, N is a
30 predetermined integer constant specifying the length of the part of the sequence of data transmitted in a transmission block of said third type, and INT is a function returning the integer part of its argument.

11. A receiver of a microwave radio link system, characterized in that the receiver comprises

- means for receiving and decoding a first transmission block comprising a part of a data sequence to be received,

5 - means for determining the length of said data sequence on the basis of information in said first transmission block, and

- means for determining the length of a second transmission block to be received at least partly on the basis of said length of said data sequence, and

10 - means for determining the number of at least third transmission blocks to be received, if any.

12. An access point of a microwave radio link system, characterized in that the access point comprises a transmitter according to claim 7.

15 13. An access point according to claim 12, characterized in that the access point further comprises a receiver according to claim 11.

14. A terminal of a microwave radio link system, characterized in that the terminal comprises a receiver according to claim 11.

20

15. A terminal according to claim 14, characterized in that the terminal further comprises a transmitter according to claim 7.

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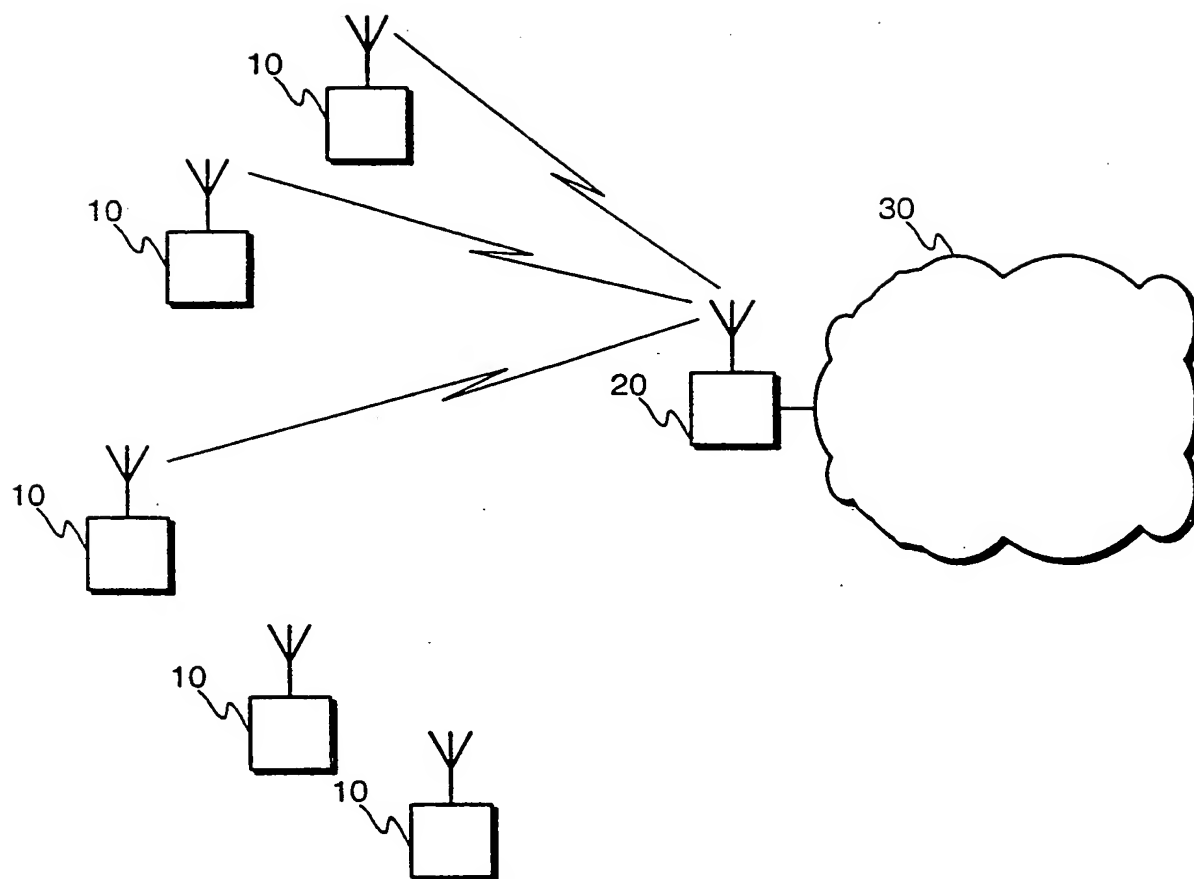


Fig. 1
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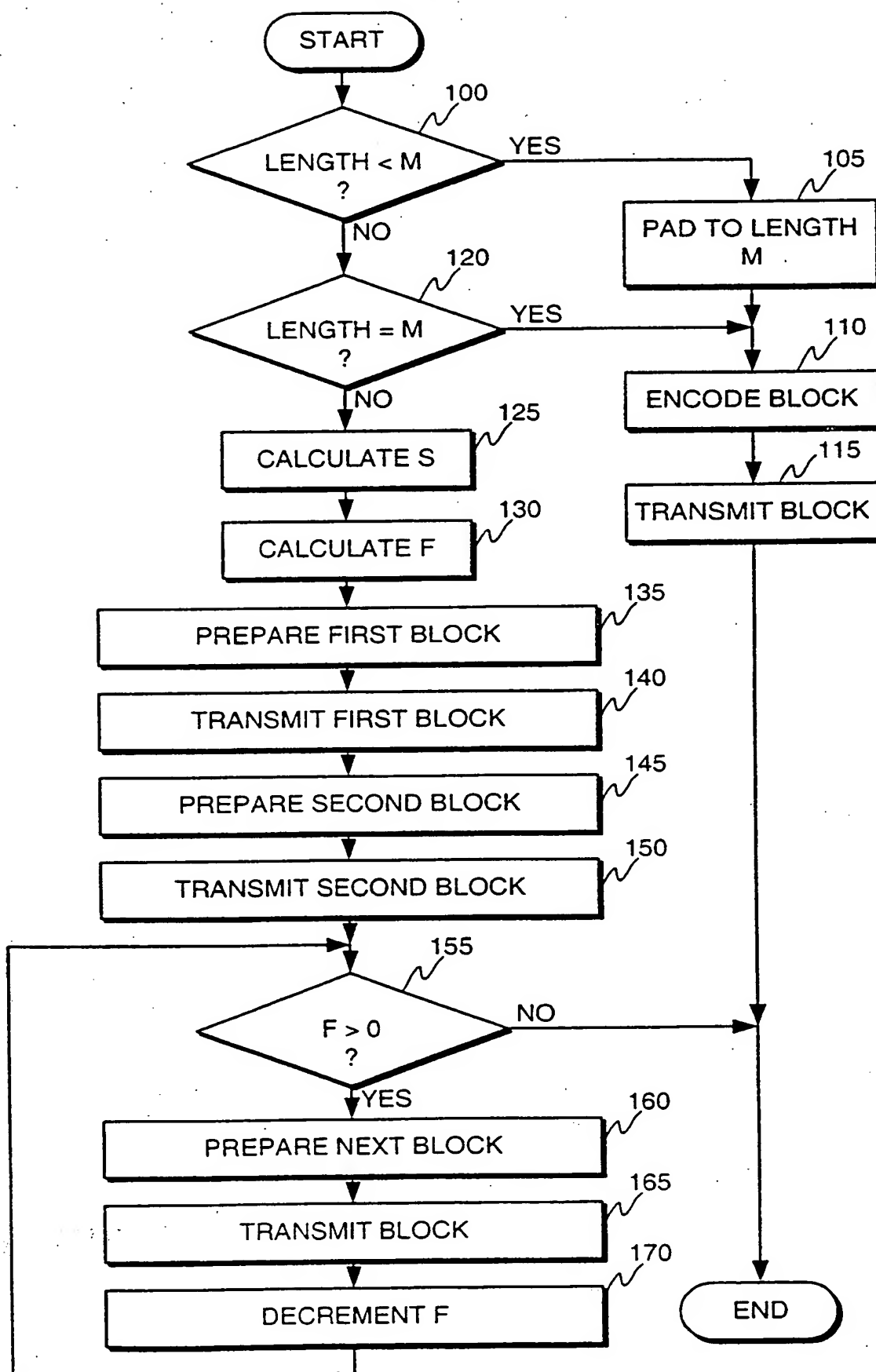


Fig. 2

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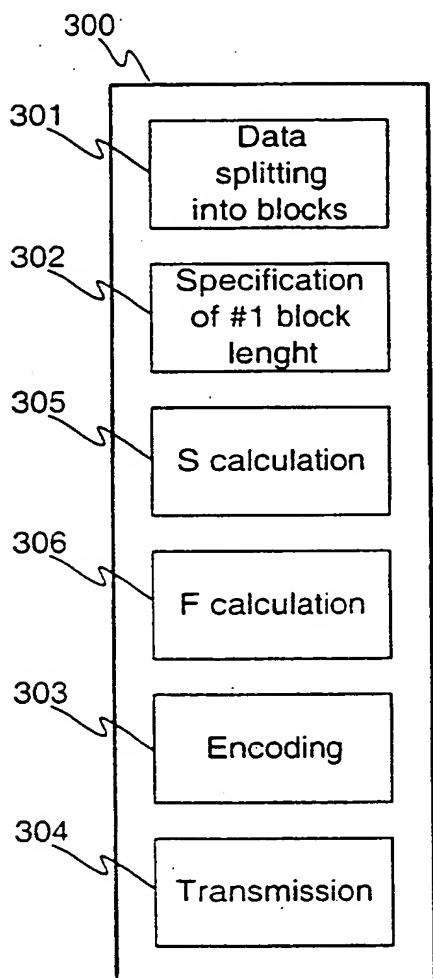


Fig. 3

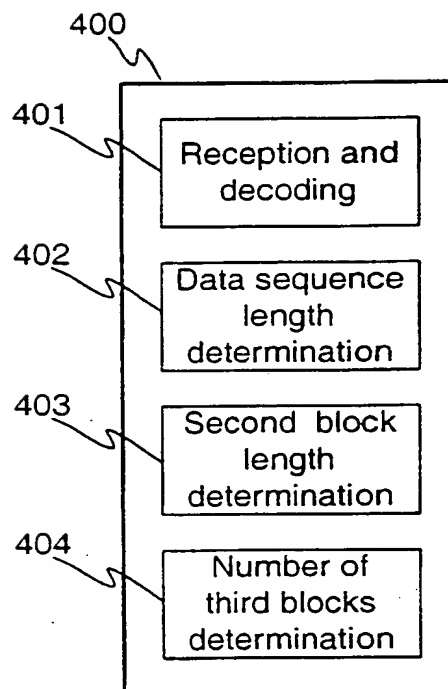


Fig. 4

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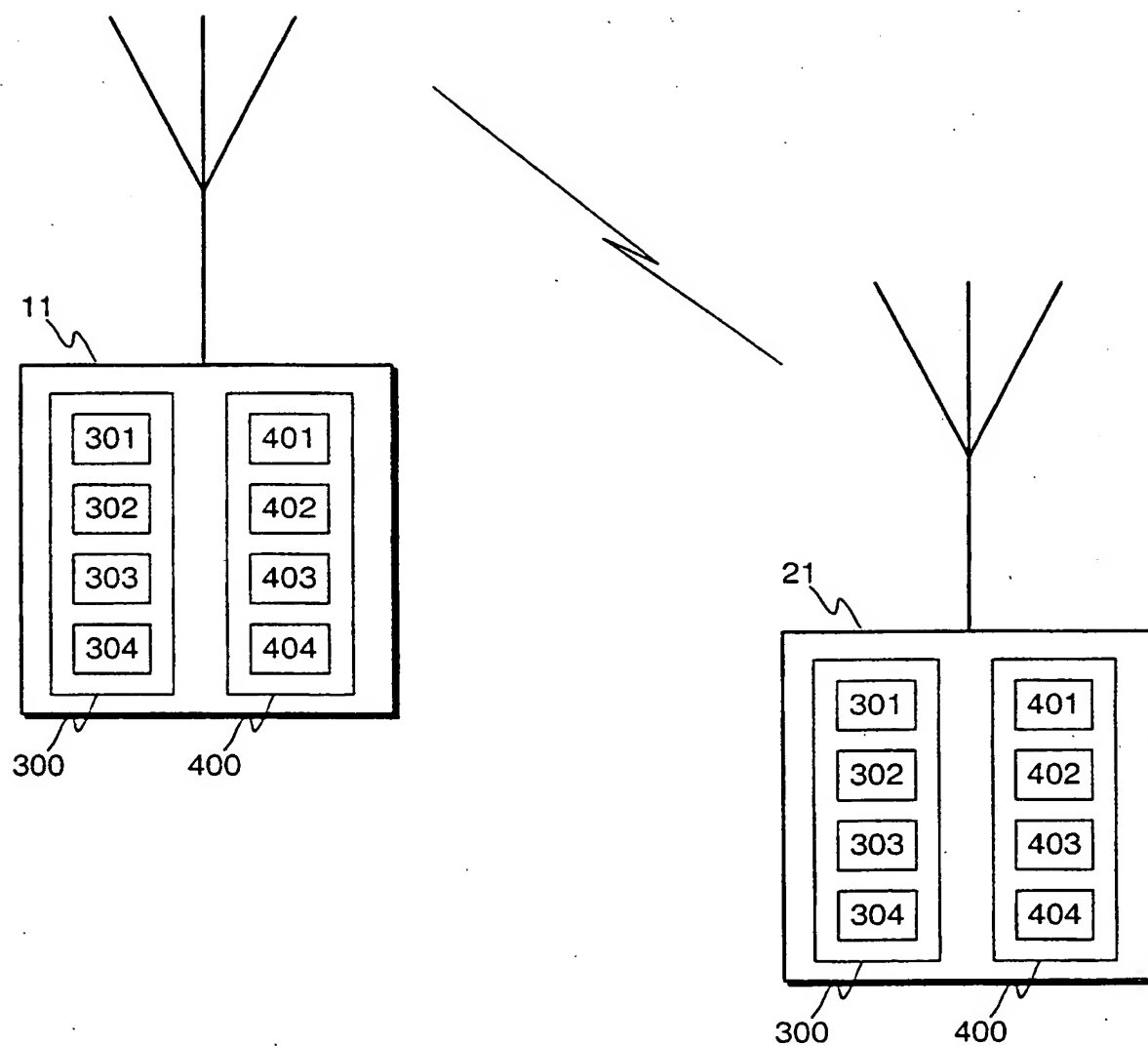


Fig. 5

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